

UDC 636.2.034

THE IMPACT OF NEW SPACE-PLANNING DECISIONS EASY-TO-ASSEMBLE
FACILITIES FOR THE MAINTENANCE AND PRODUCTIVITY OF YOUNG
CATTLE

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Abstract. *The publication shows results of studying the influence of new space-planning and technological solutions of easy-to-assemble cattle sheds on the keeping conditions and productivity of intact young bulls of Holstein dairy breed fattening. It is defined that the microclimate characteristics indices in the sheds do not go beyond acceptable norms. Inside and outside temperature differed by 1-1.5 %. Zonal location of animals in sheds allowed ensuring their leisure time period to 13.43 hours per day. Dynamics of average growth gain remained at a sufficient level for the period of 6 months prior to slaughter and was 0.986 g/d.*

Keywords: *ethological indices, productivity and physiological state of animals zonal location, microclimate*

One of the most pressing problems of today in Ukraine is the meeting of the population demand especially in beef (V. Didkivskyy, 2002). This is because the number of cattle heads in comparison to 1990 decreased almost three times, whereas beef sales decreased by 5 times in 15 years (V. Kozir, 2014; I. Hnoyevyy, 2006). As yet the low daily growth of young animals, which on average in Ukraine make 250-400 g, is three times lower than indices of the countries of the European Union. In fact, it has been reduced further during this period up to 20 %. For such low gains, the cost of feed per unit of production also increases by 2-3 times, and the weight of calves at the time

of realization is only 362 kg. Today Ukraine has lost its position in the global market as a beef exporter state (O. B. Datsko, 2013, V. Berehovyy, 2015).

A very significant problem that affects the production of beef is the fact that at this time in Ukraine lacks breeding stock of beef breeds. Of 2.8 million cows available today in farms of different ownership only 40.1 thousands are of beef breeds (L. Shpak, 2011).

The low efficiency of the sector is due to the old technology of production, and therefore the cost of labor per unit of product is 20 times higher than the cost in Europe (V. Kozyr, 2014).

It is known that the efficiency of beef production technology depends largely on the way of keeping the cattle. Today, the main way of fattening calves keeping is toggle system (V. Linnik, 2009). According to this way of keeping youngsters are kept in stalls equipped with troughs, auto-drinkers and leashes. Manure is removed by scraper conveyors. At the same time cleaning of the stalls and litter distribution requires more labor costs (S. I. Kutykov, 2009; Y. Ruban, 2011).

Along with toggle system the loose housing in several modifications is used in Ukraine: indoors or outdoors loose housing on deep litter; loose-boxed housing with a solid or slit floor; free stalls or cages housing. This method means keeping the animals in groups. At the same time, the most progressive way is loose keeping on unchanged deep litter, which makes it possible to keep by 30-50% more animals, increase the operator's load to 1000 heads, mechanize feed distribution and manure removing processes. Keeping growers indoors improves productivity and keeping on deep litter reduces expenditures per head, power consumption and enables to increase the workload per employee (S. Kutykov, 1988; V. Kostenko, 2010).

Taking into account the critical situation of beef production in the country, the problem of formation of the market of that category of meat ceases to be just an economic problem. By the contrary, acquires a sharp social nature and requires a quick restoration of this industry by increasing herd of beef cattle and construction of modern farms and cattle breeding complexes, where the technology and the level of production comply to with European requirements (O. Ordihovska, 2015). Therefore, we have been

tasked to develop new solutions of easy-to-assemble sheds and study the conditions of feeding calves in them.

The aim of research - to study the influence of new space-planning and technological solutions of easy-to-assemble cattle sheds on the conditions of keeping and productivity of intact young bulls on fattening.

Materials and methods of research. Experimental studies of the effects of easy-to-assemble cattle sheds on the conditions of feeding calves keeping were performed at ALC "Terezine" cattle farm, Bila Tserkva distr. Kyiv reg. in 2015–2016.

The new shed significantly differs from traditional ones in space-planning and technology solutions, its width was 24 m (against traditional 18-21-36 m) height - 8 m (vs. 3-5). To achieve optimum microclimate in the shed was equipped with transparent and aerated roof and side curtains which were raised in the cold season and dropped down in the warm season. In the central part there was a feeding table (5 m width), and on either side of it there was feeding and rest zone for animals (Fig. 1.2). In the recreation area, the animals use litter with straw and remove it twice a week. The composition of the mix consisted of corn for silage, senage, sunflower meal, crushed corn and barley corn. In the percentage ratio, the composition of the ration varied depending on the age of the animals. Silage 35-50%, senage 10-18% sunflower meal 13-15%, maize 14-18%, barley 8-14% for nutritional value. Feed was given out with a farm machine. In this regard, we developed a new resource saving technology of beef production with a zonal location of youngsters which was implemented for the first time in the construction of a new type of easy-to-assemble cattle shed which differs significantly in technological parameters from standard sheds now used in Ukraine.

The calculation of the economic efficiency of the resource-saving technology of beef production was made on the average base indicators: gross production of product, price of the alive weigh on the moment of product sale, cost of food, electricity, fuels and payroll cost.

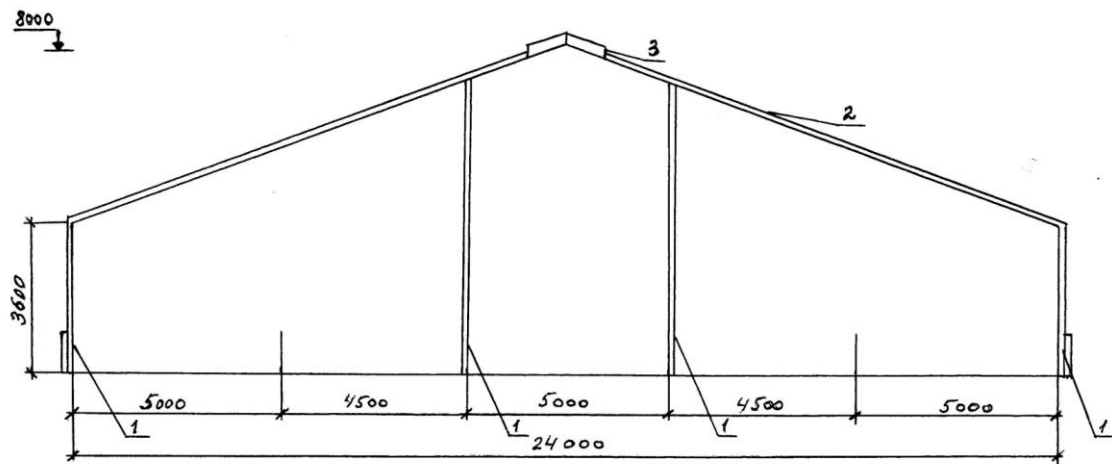


Fig. 1. Cross section of the easy-to-assemble cattle shed for feeding young cattle

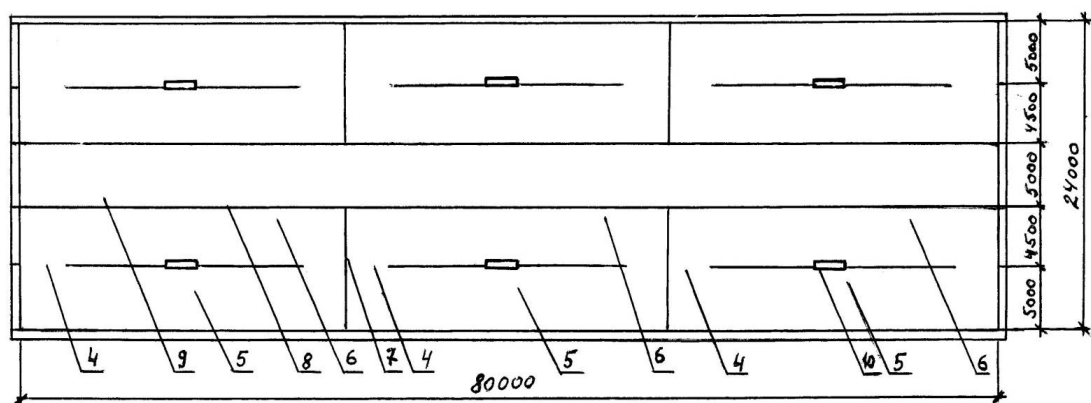


Fig. 2. Section for keeping feeding youngsters. 1. metal column; 2. metal beam 3. transparent and aerated roof; 4. section for keeping the fattening youngsters; 5. area for the animals rest; 6. feeding zone; 7. fence of sections; 8. feeding table fence; 9. feeding table; 10. drinker for animals

The investigation included studies of the easy-to-assemble cattle shed new space-planning and technological solutions influence on conditions of feeding youngsters, their productivity and behavior. To fulfill these tasks we studied the microclimate in the shed, ethological indices and productivity of animals in the new resource saving technologies conditions based on using the one type feeding of full-feed formula during a year. Preparation and distribution of feed was performed by a mobile mixer-distributor which provided feeding to animals with concentrated feedstuff, according to diet for the whole period of fattening.

Microclimatic indices assessment was performed in a fully inhabited shed. The temperature and relative humidity was measured with TTM-2-02 wire anemometers, air velocity - with catathermometer, ammonia and hydrogen sulfide content - with gas analyzer universal UG-2 device, light – with luxmeter.

Observation method allows us to study the behavior of animals in industrial conditions without interfering with routine and without prejudice to the functional and physiological state of animals (M. Zubets, 1996). To evaluate the behavior of animals in the easy-to-assemble cattle shed conditions we used the method (E. Admin, 1982), which involves observation of the whole group of animals, in this case - 49 heads of Holstein breed. Every 10 minutes the number of animals manifesting certain acts of behavior was registered. The calculations were as follows:

$$T_n = \frac{24 \cdot n}{100};$$

where:

24 – hours in a day;

n – number of animals registered in certain position, heads.

Weighing of animals was made at the age of 6, 9, 12, 15, 17 months at fixed weigher. The average growth gain was determined by the formula:

$$Dc = \frac{W_1 - W_0}{t}$$

where:

t – number of days in the period;

W_1 – weigh of animals at the end of the period, kg

W_0 – weigh of animals at the beginning of the period, kg

Results and discussion. It was found that temperature conditions in the shed depend on the ambient (outdoors) temperature. The most critical in terms of optimal microclimate parameters provision was winter and in-between season periods. Therefore, evaluating of the premises effectiveness was carried out at a temperature of -

3.0 ... +5.2°C, respectively. Figure 2 shows the temperature variations during the day. The difference between the outdoors and indoors temperature during the day was only one and a half degrees.

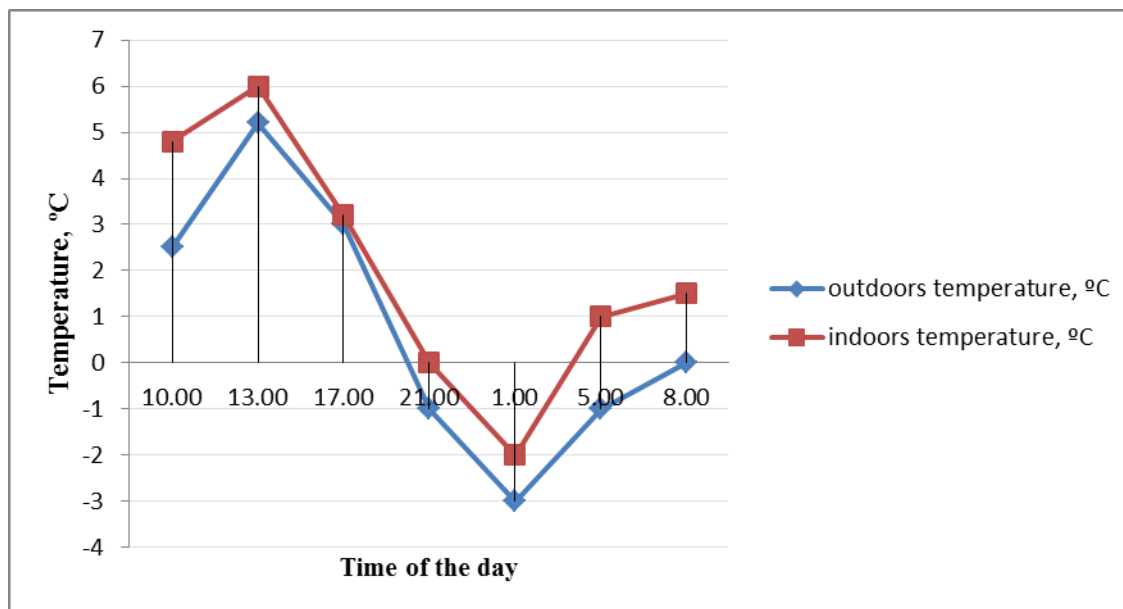


Fig. 3 Dynamic of mean daily values of ambient temperature indoors vs. outdoors of the winter period

The main parameters of the microclimate in newly built shed are set forth in Table 1. It is established that the side curtains and transparent and aerated roof enables increased air movement versus departmental technological design rules, and respectively the reduction of harmful gases emissions. Thus, the ammonia content in the new building was at 0.5-1.5 mg/m³ level, that is by 13-20 times less when as compared to the standards, whereas the content of hydrogen sulfide was 25 times lower than the maximum permissible levels.

The use of new structural elements in the design, construction, and operation of the easy-to-assemble cattle shed ensures feeding youngsters keeping in proper quality conditions. The particular aspects of indoors temperature dependence on the ambient temperature were found out. The side curtains and transparent and aerated roof positively effect on lowering harmful gases level indoors even if the curtains are closed.

1. Microclimate indices in the new shed

Index	Standard indices according to *DNTD-AC-01-05	New shed, width - 24 m
Air velocity, m/sec	0,3-0,4	0,5 ± 0,07
Ammonia availability, mg/m ³	20,0	0,5-1,5
hydrogen sulphide, mg/m ³	10,0	0,4
Natural light in the shed	-	27,43

*Departmental norms for technological design of agro-industrial complexes

During fattening of intact young bulls an important element of the technology is their behavior, especially in the conditions of the proposed zonal location of the animals. It is important that intact young bulls were less excited and spent more time resting and eating.

Our research shows that zonal location of intact young bulls positively affected their behavior (Table. 2). A 55.88% of the time the animals were lying down. However, 26.26% of the time they were lying down and chewing the cud. This indicates that they felt comfortable while resting.

An important element of animal behavior is their physical activity. For animals on fattening it is desirable to reduce physical activity in order to increase weight gain and reduce energy consumption (K. Petrov, N. Iliev, N. Ivanov, 1978; B. Mokhov, 1991; V. Linnyk, 2009). Time of the animals' active movement during the day was only 2.29 hours. So, zonal planning of the production area influences a calm condition in the group of animals.

Changing of the stereotype of eating behavior caused by the violation of the daily routine and feeding regime leads to lower productivity (B. Mokhov, 2009; M. Zubets, 1996). Ethological investigations also showed that the time spent on daily diet intake was only 16.54% of the time of day, indicating that the mode of feeding, a diet structure, its energy intensity, physical and physical-mechanical properties fully meet the physiological needs of feeding youngsters. Moreover, feeding offered to animals during the experiment was in ad libitum. Forage mixture was served once a day.

Extremely important indicator to assess the effectiveness of resource saving technology of intact young bulls fattening are manifestations of sexual behavior of

animals, especially in the final stages of fattening (B. Nowicki, B., 1981). Figure 3 shows that the time spent on sexual manifestations by intact young bulls is only 0.16 or 0.68% h of the time of day, indicating the positive impact of their zonal location and adopted feeding technology (Fig. 3).

2. Intact young bulls behavior in the new technology conditions (n = 49)

Behavior manifestation of animals	hours	%
Lying down idle	7,11	29,62
Lying down and chewing the cud	6,3	26,26
Standing idle	2,55	10,64
Standing and eating	3,97	16,54
Standing and chewing the cud	1,44	6,01
Standing and drinking water	0,17	0,71
Walking	2,29	9,54
Sexual manifestations	0,16	0,68
Total	24	100

In the study, the duration of any and all animal life acts did not exceed the time limits of optimal and consistent biological standards. Adequate rest duration, low physical activity, intense consumption of feed, and moderate sexual activity created good conditions for the utilization of energy consumed as well as the nutrients. Resulting in better growth and development, meat productivity and payback of feeds during fattening period.

It is known that the main indicator to assess any technology is the productivity of animals, which comprehensively reflects the advantages or disadvantages of the adopted technology. Therefore, assessing the new resource-saving technology of beef production, which is based on zonal location of youngsters in a new type of sheds, we studied the influence of new technologies on the animals' productivity in different periods of feeding.

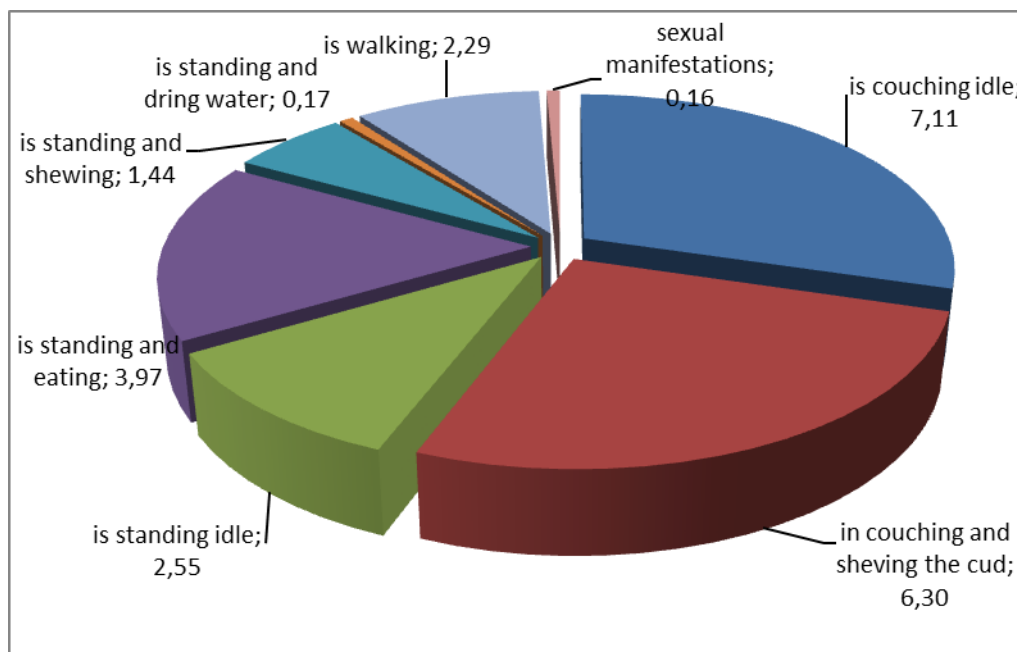


Fig. 4 Main life acts of feeding youngsters during the day

The bulls from black spotted and Holstein dairy cows were taken into the experiment at 6 months of age and a body weight = 193.6 kg. (Table 3).

3. Fattening youngsters productivity indices ($M \pm m$; $n = 49$)

Indices	Breed standard	Holstein
Average live weight of bulls at the beginning of the experiment, kg (6 months of age).	190	193.2 \pm 2.98
Live weight at 9 months	274.0	280.0 \pm 2.95
Daily average gain, kg	-	0.964 \pm 0.004
Live weight at 12 months	365	368.9 \pm 3.13
Daily average gain, kg	-	0.967 \pm 0.004
Live weight at 15 months	445.0	461.6 \pm 2.95
Daily average gain, kg	-	1.008 \pm 0.019
Live weight at 17 months	486.0	522.1 \pm 2.95
Daily average gain, kg	-	0.992 \pm 0.007
Live weight at the end of experiment, kg (Age 22 months)	-	630.84 \pm 4.73
Daily average gain, kg	-	1.001 \pm 0.004
Daily average gain for the whole period, kg	-	0.986 \pm 0.005

The data in Table 3 shows that youngsters cattle successfully adapted to new technology, showing a consistently and high weight gain. Average daily gain during the experiment amounted to 960 g. Analyzing growth and development indices of bulls it

Луценко М. М., Ластовська І. О., Донченко Т. А., Косіор Л. Т., Пірова Л. В., Аріас Іностроза Р. А.

was found out that the highest average daily growth showed the animals at the age of nine months when the gain was 1.04 kg.

Comparing the live weight of experimental animals of the Holstein breed with the standard breed, it is clear that animals do not lag behind in growth and development and have relatively the same live weight, which ranged from 1 to 7.42%.

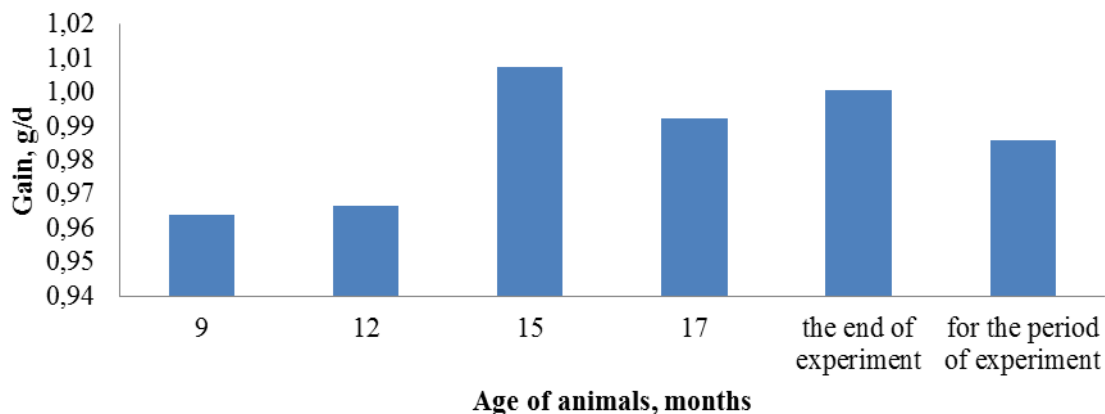


Fig. 6 Dynamics of feeding youngsters daily average gains

The highest levels of daily average gains was observed when animals aged 15 months, whit 1,008 g/day. The results, given in the table 4, approve the high efficiency of the resource-saving technology of beef production on the conditions of using the easy-to-assemble premises.

4. The economic efficiency of the resource-saving technology of beef production on the conditions of using the easy-to-assemble premises

Indicator	UAH ₴
Cost of easy-to-assemble premise with equipment set, UAH	1,262,983
Gross product output, center	719.78
Price for 1 kg of live weight, UAH	32.0
Total value of weight gain, UAH	2,303,296
Manure output, kg	2555
Price for 1 ton of manure (selling), UAH	90
Total value of manure sold, UAH	229,950
Total value of product, UAH	2,533,246
Consumption of fodder units for 1 kg of weight gain, fodder units	7.61
Gross consumption of fodder, center fodder units	5,477.5
Cost of fodder, thousands of UAH	652,115
Payroll cost, thousands of UAH	66,879
Depreciation cost, thousands of UAH	88,409
Electricity consumption, kWh	23,725
Price for electricity, UAH /kWh	1.81
Electricity cost, UAH	42,942.25
Fuel consumption, kg	820
Price for fuel, UAH/kg	20
Cost of fuel, UAH	16,400
Total cost of product for up to 6 months calf growing , UAH	1,238,293
Cost of 1 center of product, UAH	1,720.37
Product sales revenue, UAH	2,533,246
Net profit, UAH	1,666,501
Production profitability , %	135
Labor consumption for 1 center of beef production, men hours	4.1

1\$ =26.4 ₴

Conclusions. The new resource-saving technology of beef production is effective. New space-planning and technological solutions of facilities for feeding youngsters keeping provide comfortable conditions for them, allowing high average daily gains of bulls from cows of a dairy breed.

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ВПЛИВ НОВИХ ОБ'ЄМНО-ПЛАНУВАЛЬНИХ РІШЕНЬ ЛЕГКОЗБІРНИХ ПРИМІЩЕНЬ НА УТРИМАННЯ І ПРОДУКТИВНІСТЬ МОЛОДНЯКУ ВЕЛИКОЇ РОГАТОЇ ХУДОБИ

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Розроблені об'ємно-планувальні і технологічні рішення легкозбірного приміщення шириною 24 м, яке облаштоване світлоаераційним гребнем і

Луценко М. М., Ластовська І. О., Донченко Т. А., Косіор Л. Т., Пірова Л. В., Аріас Іностроза Р. А.

боковими шторами для забезпечення оптимального мікроклімату приміщення. У центральній частині відгодівельника кормовий стіл шириною 5 м, а по обидва боки від нього станки розділені на зону годівлі та відпочинку тварин.

Встановлено, що наявність у приміщенні бокових штор і світлоареаційного гребня забезпечують підвищення руху повітря порівняно з відомчими нормами технологічного проектування, а відповідно, і зниження вмісту шкідливих газів. Так, вміст аміаку в новому приміщенні перебував на рівні 0,5-1,5 мг/м³, що в 13-20 разів менше порівняно з нормативами, а вміст сірководню був у 25 разів нижчий від гранично допустимих рівнів.

Зонне розміщення бугайців позитивно впливає на їхню поведінку, адже 55,88 % часу доби тварини відпочивають у положенні лежачи. При цьому вони 26,26 % часу доби в положенні лежачи жують жуйку, що свідчить про комфортність їх відпочинку. Тривалість пересування піддослідних тварин протягом доби склала лише 2,29 год. Тобто зонне планування виробничих площ впливає на формування спокійної обстановки в групі тварин.

Витрати часу на споживання добового раціону склало лише 16,54 % часу доби, що свідчить про те, що режим годівлі тварин, структура раціону, його енергонасиченість та фізико-механічні властивості в повній мірі відповідають фізіологічним потребам відгодівельного молодняка.

Відгодівельний молодняк досить успішно адаптується до нової технології і характеризується стабільними і високими середньодобовими приростами за період вирощування та відгодівлі.

Ключові слова: етологічні показники, продуктивність та фізіологічний стан, зонне розміщення тварин, мікроклімат

ВЛИЯНИЕ НОВЫХ ОБЪЕМНО-ПЛАНИРОВОЧНЫХ РЕШЕНИЙ ЛЕГКОСБОРНОГО ПОМЕЩЕНИЯ НА СОДЕРЖАНИЕ И ПРОДУКТИВНОСТЬ МОЛОДНЯКА КРУПНОГО РОГАТОГО СКОТА М. М. Луценко, И. А. Ластовская, Т. А. Донченко, Л. Т. Косиор, Л. В. Пірова, Р. А. Ариас Иностроза

Разработанные объемно-планировочные и технологические решения легкосборных помещения шириной 24 м, которое оборудовано светоаэрационным коньком и боковыми шторами для обеспечения оптимального микроклимата помещения. В центральной части помещения кормовой стол шириной 5 м, а по обе стороны от него станки разделены на зону кормления и отдыха животных.

Установлено, что наличие в помещении боковых штор и светоаэрационного конька обеспечивают повышение движения воздуха по сравнению с ведомственными нормами технологического проектирования, а соответственно, и снижение содержания вредных газов. Так, содержание аммиака в новом помещении находился на уровне 0,5-1,5 мг / м³, что в 13-20 раз меньше по сравнению с нормативами, а содержание сероводорода был в 25 раз ниже предельно допустимых уровней.

Луценко М. М., Ластовська І. О., Донченко Т. А., Косіор Л. Т., Пірова Л. В., Аріас Іностроза Р. А.

Зонноеразміщення бычків, позитивно впливає на їх поведінку, так як 55,88 % часу сутки відпочивають в положенні лежачи. При цьому 26,26 % часу сутки в положенні лежачи жують жвачку, що свідчить про комфортність їх відпочинку. Продовжителість переміщення підопитних тварин в течение сутки склала всього 2,29 ч. Це означає, що зонне планування виробничих площ впливає на формування спокійної обстановки в групі тварин.

Витрати часу на вживання добового раціону склали лише 16,54% часу сутки, що свідчить про те, що режим годівлі тварин, структура раціону, його енергонасиченість і фізико-механічні властивості в повній мірі відповідають фізіологічним потребам відгодівельного теляти.

Відгодівельний телятник досить успішно адаптується до нової технології і характеризується стабільними і високими середньодобовими приростами за період вирощування і відгодівлі.

Ключові слова: *етиологічні показники, продуктивність і фізіологічний стан тварин, зональне розташування, мікроклімат*